U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: CONTINUING STRUCTURAL INTEGRITY PROGRAM FOR LARGE TRANSPORT CATEGORY AIRPLANES	**Date:** 5/23/01	**AC No:** 91-56BX
	Initiated by: ANM-110	**Change:** DRAFT 5

1. PURPOSE.

a. This Advisory Circular (AC) describes an acceptable means for showing compliance with various requirements of Title 14, Code of Federal Regulations, that concern establishing a program to address widespread fatigue damage (WFD) in transport category airplanes. This AC provides guidance to type certificate holders and operators of transport category airplanes for use in developing a continuing structural integrity program to ensure safe operation of older airplanes throughout their operational life, including provision to preclude WFD. This guidance material applies to large transport airplanes that:

- were certificated under the fail-safe and fatigue requirements of Civil Air Regulations (CAR) 4b or 14 CFR part 25 (except for the "Supplemental Inspection Program" which is applicable to airplanes certified to pre-amendment 25-45);
- have a maximum gross takeoff weight greater than 75,000 pounds; and
- are operated under 14 CFR parts 91, 121, 125, 129, or 135.

b. The means of compliance described in this document provides guidance to supplement the engineering and operational judgment that must form the basis of any compliance findings relative to continuing structural integrity programs for large transport category airplanes

c. The guidance provided in this document is directed to airplane and engine manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration transport airplane type certification engineers and their designees.

d. Like all advisory circular material, this AC is not, in itself, mandatory, and does not constitute a regulation. It describes an acceptable means, but not the only means, for showing compliance with the requirements for transport category airplanes. Terms such as "shall" and "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described in this document is used. While these guidelines are dependent, and our knowledge about them can best be assessed based on real-time operational experience and the use of the most modern tools of analysis and testing.

b. The Federal Aviation Administration (FAA), type certificate holders, and operators have continually worked to maintain the structural integrity of older airplanes. Traditionally, this has been carried out through an exchange of field service information and subsequent changes to inspection programs and by the development and installation of modifications on particular aircraft. However, increased use, longer operational lives, and the high safety demands imposed on the current fleet of transport airplanes indicate the need for a program to ensure a high level of structural integrity for all airplanes in the transport fleet. Accordingly, the inspection and evaluation programs outlined in this AC are intended to ensure:

- a continuing structural integrity assessment by each airplane manufacturer, and
- the incorporation of the results of each assessment into the maintenance program of each operator.

5. DEFINITIONS AND ACRONYMS.

a. For the purposes of this AC, the following definitions apply:

(1) **Damage-tolerance** is the attribute of the structure that permits it to retain its required residual strength without detrimental structural deformation for a period of use after the structure has sustained a given level of fatigue, corrosion, and accidental or discrete source damage.

(2) **Design Service Goal (DSG)** is the period of time (in flight cycles/hours) established at design and/or certification during which the principal structure will be reasonably free from significant cracking including widespread fatigue damage.

(3) **Extended Service Goal (ESG)** is an adjustment to the design service goal established by service experience, analysis, and/or test during which the principal structure will be reasonably free from significant cracking including widespread fatigue damage.

(4) **Principal Structural Element (PSE)** is an element that contributes significantly to the carrying of flight, ground or pressurization loads, and whose integrity is essential in maintaining the overall structural integrity of the airplane.

(5) **Widespread Fatigue Damage (WFD)** in a structure is characterized by the simultaneous presence of cracks at multiple structural details that are of sufficient size and density whereby the structure will no longer meet its damage-tolerance requirement (i.e., to maintain its required residual strength after partial structural failure).

SMP	Structural Modification Point
SSID	Supplemental Structural Inspection Document
SSIP	Supplemental Structural Inspection Program

6. <u>SUPPLEMENTAL STRUCTURAL INSPECTION PROGRAMS</u>. The type certificate holder (TCH), in conjunction with operators, is expected to initiate the development of a Supplemental Structural Inspection Program (SSIP) for each airplane model. Such a program must be implemented before analysis, tests, and/or service experience indicates that a significant increase in inspection and/or modification is necessary to maintain structural integrity of the airplane. In the absence of other data as a guideline, the program should be initiated no later than the time when the high-time or high-cycle airplane in the fleet reaches one half its design service goal. This should ensure that an acceptable program is available to the operators when needed. The program should include procedures for obtaining service information, and assessment of service information, available test data, and new analysis and test data. A Supplemental Structural Inspection Document (SSID) should be developed, as outlined in Appendix 1 of this AC, from this body of data.

a. The recommended SSIP, along with the criteria used and the basis for the criteria should be submitted to the cognizant FAA Aircraft Certification Office for review and approval. The SSIP should be adequately defined in the SSID. The SSID should include the type of damage being considered, and likely sites; inspection access, threshold, interval, method and procedures; applicable modification status and/or life limitation; and types of operations for which the SSID is valid.

b. The FAA's review of the SSID will include both engineering and maintenance aspects of the proposal. Because the SSID is applicable to all operators and is intended to address potential safety concerns on older airplanes, the FAA will make it mandatory under the existing Airworthiness Directive (AD) system. In addition, the FAA will issue AD's to implement any service bulletins or other service information publications found to be essential for safety during the initial SSID assessment process. Service bulletins or other service information publications revised or issued as a result of in-service findings resulting from implementation of the SSID should be added to the SSID or will be implemented by separate AD action, as appropriate.

c. In the event an acceptable SSID cannot be obtained on a timely basis, the FAA may impose service life, operational, or inspection limitations to assure structural integrity.

d. The TCH should revise the SSID whenever additional information shows a need. The original SSID will normally be based on predictions or assumptions (from analyses, tests, and/or service experience) of failure modes, time to initial damage, frequency of damage, typically detectable damage, and the damage growth period. Consequently, a change in these is expected that the results will include recommendations for necessary inspections or modification and/or replacement of structure, as appropriate. It is expected that the TCH will work closely with operators in the development of these programs to assure that the expertise and resources are available when implemented.

e. The FAA's review of the WFD evaluation results will include both engineering and maintenance aspects of the proposal. Since WFD is a safety concern for all operators of older airplanes, identified inspection or modification and/or replacement programs are proposed to be made mandatory by operational rules applicable to 14 CFR parts 91, 121, 125, 129, and 135. In addition, any service bulletins or other service information publications revised or issued as a result of in-service MSD/MED findings resulting from implementation of these programs may require separate AD action.

f. In the event an acceptable WFD evaluation is not completed on a timely basis, the FAA is proposing to impose service life restrictions, operational limitations, or inspection requirements to ensure structural integrity.

g. It is expected that the original recommended actions stemming from a WFD evaluation will be focused on those structural items that are soon expected to reach a point at which MSD/MED is predicted to occur. As the fleet ages, more areas of the airplane may reach the life at which MSD/MED is predicted to occur in those details, and the recommended service actions should be updated accordingly. Also, new service experience findings, improvements in the prediction methodology, better load spectrum data, or a change in any of the factors upon which the WFD evaluation is based may dictate a revision to the evaluation. Accordingly, associated new recommendations for service action should be developed and submitted to the FAA for review and approval of both engineering and maintenance aspects.

h. Operators will be expected to accomplish a WFD evaluation of applicable modified, repaired, or altered structure. The results must be presented for review and approval to the cognizant FAA Aircraft Certification Office having type certificate responsibility for the airplane model being considered.

11. IMPLEMENTATION. Once the FAA issues a SSID AD, operators must amend their current structural inspection programs to comply with and account for the applicable AD. The program to preclude WFD in the fleet has been mandated by operational rules, which require operators to amend the current structural maintenance programs. Any AD's issued as a result of a WFD finding that require structural modification will be handled separately. In all cases, compliance is required in accordance with the applicable regulations.

APPENDIX 1

GUIDELINES FOR DEVELOPMENT OF THE SUPPLEMENTAL STRUCTURAL INSPECTION DOCUMENT

1. GENERAL.

a. This appendix to AC 91-56B applies to transport category airplanes that were certificated prior to amendment 25-45 of 14 CFR part 25. That amendment introduced § 25.571, which emphasizes damage-tolerant design. However, the structure to be evaluated, the type of damage considered (fatigue, corrosion, service, and production damage), and the inspection and/or modification criteria should, to the extent practicable, be in accordance with the damage-tolerance principles of the current § 25.571 standards. An acceptable means of compliance can be found in AC 25.571-1C ("Damage-Tolerance and Fatigue Evaluation of Structure," dated April 29, 1998) or the latest revision.

b. It is essential to identify the structural parts and components that contribute significantly to carrying flight, ground, pressure, or control loads, and whose failure could affect the structural integrity necessary for the continued safe operation of the airplane. The damage-tolerance or safe-life characteristics of these parts and components must be established or confirmed.

c. Analyses made in respect to the continuing assessment of structural integrity should be based on supporting evidence, including test and service data. This supporting evidence should include consideration of the operating loading spectra, structural loading distributions, and material behavior. An appropriate allowance should be made for the scatter in life to crack initiation and rate of crack propagation in establishing the inspection threshold, inspection frequency, and, where appropriate, retirement life. Alternatively, an inspection threshold may be based solely on a statistical assessment of fleet experience, if it can be shown that equal confidence can be placed in such an approach.

d. An effective method of evaluating the structural condition of older airplanes is selective inspection with intensive use of non-destructive techniques, and the inspection of individual airplanes, involving partial or complete dismantling ("teardown") of available structure.

e. The effect of repairs and modifications approved by the manufacturer should be considered. In addition, it may be necessary to consider the effect of repairs and operator-approved modifications on individual airplanes. The operator has the responsibility for ensuring notification and consideration of any such aspects.

(2) the typical operational mission or missions assumed in the assessment;

(3) the structural loading conditions from the chosen missions; and

(4) supporting test evidence and relevant service experience.

b. In addition to the information specified in paragraph 3.a., above, the following should be included for each critical part or component:

(1) the basis used for evaluating the damage-tolerance characteristics of the part or component;

(2) the site or sites within the part or component where damage could affect the structural integrity of the airplane;

(3) the recommended inspection methods for the area;

(4) for damage-tolerant structures, the maximum damage size at which the residual strength capability can be demonstrated and the critical design loading case for the latter; and

(5) for damage-tolerant structures, at each damage site the inspection threshold and the damage growth interval between detectable and critical, including any likely interaction effects from other damage sites.

NOTE: Where reevaluation of fail-safety or damage tolerance of certain parts or components indicates that these qualities cannot be achieved, or can only be demonstrated using an inspection procedure whose practicability or reliability may be in doubt, replacement or modification action may need to be defined.

4. INSPECTION PROGRAM. The purpose of a continuing airworthiness assessment in its most basic terms is to adjust the current maintenance inspection program, as required, to assure continued safety of the airplane type.

a. In accordance with paragraphs 1. and 2. of this appendix, an allowable limit of the size of damage should be determined for each site such that the structure has a residual strength for the load conditions specified in § 25.571, as defined in paragraph 2.c. The size of damage that is practical to detect by the proposed method of inspection should be determined, along with the number of flights required for the crack to grow from detectable to the allowable limit.

b. The recommended inspection program should be determined from the data described in paragraph 4.a., above, giving due consideration to the following:

(5) a list of service bulletins (or other service information publication) revised as a result of the structural reassessment undertaken to develop the SSID, including a statement that the operator must account for these service bulletins.

b. The document should contain at least the following information for each critical part or component:

(1) a description of the part or component and any relevant adjacent structure, including means of access to the part;

(2) the type of damage which is being considered (i.e., fatigue, corrosion, accidental damage);

(3) relevant service experience;

(4) likely site(s) of damage;

(5) recommended inspection method and procedure, and alternatives;

(6) minimum size of damage considered detectable by the method(s) of inspection;

(7) service bulletins (or other service information publication) revised or issued as a result of in-service findings resulting from implementation of the SSID (added as revision to the initial SID);

(8) guidance to the operator on which inspection findings should be reported to the manufacturer;

(9) recommended initial inspection threshold;

(10) recommended repeat inspection interval;

(11) reference to any optional modification or replacement of part or component as terminating action to inspection;

(12) reference to the mandatory modification or replacement of the part or component at given life, if fail-safety by inspection is impractical; and

(13) information related to any variations found necessary to "safe lives" already declared.

c. The SSID should be compared from time to time against current service experience. Any unexpected defect occurring should be assessed as part of the continuing assessment of structural

APPENDIX 2

GUIDELINES FOR THE DEVELOPMENT OF A PROGRAM TO PRECLUDE THE OCCURRENCE OF WIDESPREAD FATIGUE DAMAGE

1. DEFINITIONS

a. WFD (average behavior) is the point in time when 50% of the fleet is expected to reach WFD for a particular detail.

b. Inspection Start Point (ISP) is the point in time when special inspections of the fleet are initiated due to a specific probability of having a MSD/MED condition.

c. Structural Modification Point (SMP) is a point reduced from the WFD average behavior (i.e., lower bound), so that operation up to that point provides equivalent protection to that of a two-lifetime fatigue test. No airplane may be operated beyond the SMP without modification or part replacement.

d. Teardown is the destructive inspection of structure, using visual and non-destructive inspection technology, to characterize the extent of damage within a structure with regard to corrosion, fatigue, and accidental damage.

e. Large Damage Capability (LDC) is the ability of the structure to sustain damage visually detectable under an operator's normal maintenance that is caused by accidental damage, fatigue damage, and environmental degradation, and still maintain limit load capability with MSD to the extent expected at SMP.

f. Scatter Factor is a life reduction factor used in the interpretation of fatigue analysis and fatigue test results.

g. Test-to-Structure Factor is a series of factors used to adjust test results to full-scale structure. These factors could include, but are not limited to, differences in:

- stress spectrum,
- boundary conditions,
- specimen configuration,
- material differences,
- geometric considerations, and

Corrosion Prevention and Control Program, Supplemental Structural Inspection Program and Repair Assessment Program.

f. There are alternative methods for accomplishing a WFD assessment other than that given in this AC. For example, AC 25-571-1C Paragraph 6.C(4) or latest revision contains guidance material for the evaluation of structure using risk analysis techniques.

3. STRUCTURAL EVALUATION FOR WFD.

a. **General**. The evaluation has three objectives:

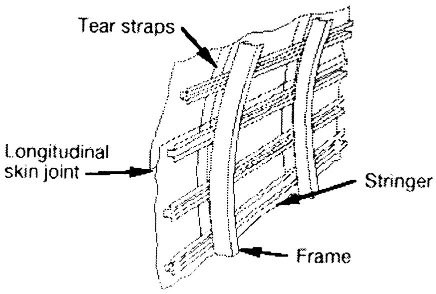
(1) Identify primary structure susceptible to MSD/MED (see paragraph 3.b of this appendix).

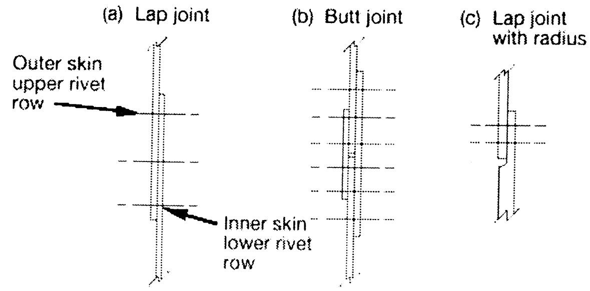
(2) Predict when it is likely to occur (see paragraph 3.c. of this appendix).

(3) Establish additional maintenance actions, as necessary, to ensure continued safe operation of the airplane (see paragraph 3.d. of this appendix).

b. **Structure Susceptible to MSD/MED.** Susceptible structure is defined as that which has the potential to develop MSD/MED. Such structure typically has the characteristics of multiple similar details operating at similar stresses where structural capability could be affected by interaction of multiple cracking at a number of similar details. The following list contains known types of structure susceptible to MSD/MED:

STRUCTURAL AREA	SEE FIGURE
Longitudinal Skin Joints, Frames, and Tear Straps (MSD/MED)	A2-1
Circumferential Joints and Stringers (MSD/MED)	A2-2
Lap joints with Milled, Chem-milled or Bonded Radius (MSD)	A2-3
Fuselage Frames (MED)	A2-4
Stringer to Frame Attachments (MED)	A2-5
Shear Clip End Fasteners on Shear Tied Fuselage Frames (MSD/MED)	A2-6
Aft Pressure Dome Outer Ring and Dome Web Splices (MSD/MED)	A2-7
Skin Splice at Aft Pressure Bulkhead (MSD)	A2-8
Abrupt Changes in Web or Skin Thickness — Pressurized or Unpressurized Structure (MSD/MED)	A2-9
Window Surround Structure (MSD, MED)	A2-10
Over Wing Fuselage Attachments (MED)	A2-11
Latches and Hinges of Non-plug Doors (MSD/MED)	A2-12

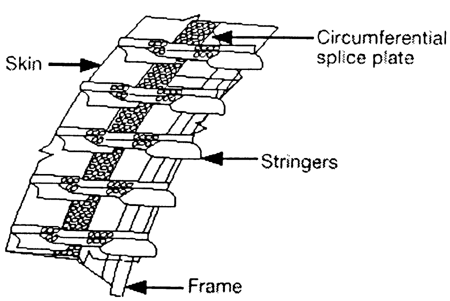


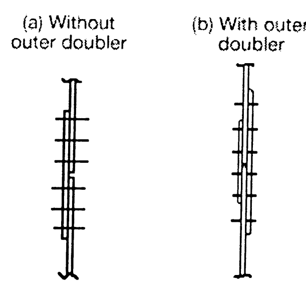


Type and possible location of MSD and MED
- MSD longitudinal skin joint
  - Lap joint
    - Outer skin upper rivet row
    - Inner skin lower rivet row
  - Butt joint
    - Skin outer rivet rows
    - Doubler inner rivet rows
  - Lap joint with radius
    - In radius
- MED—frame
  - Stress concentration areas
- MED—tear straps
  - Critical fastener rows in the skin at tear strap joint

Service or test experience of factors that influence MSD and MED (examples)
- High stress—misuse of data from coupon test
- Corrosion
- Disbond
- Manufacturing defect
  - Surface preparation
  - Bond laminate too thin
  - Countersink, fastener fit
- Design defect—surface preparation process

Figure A2-1 ***Longitudinal Skin Joints, Frames, and Tear Straps (MSD/MED)***

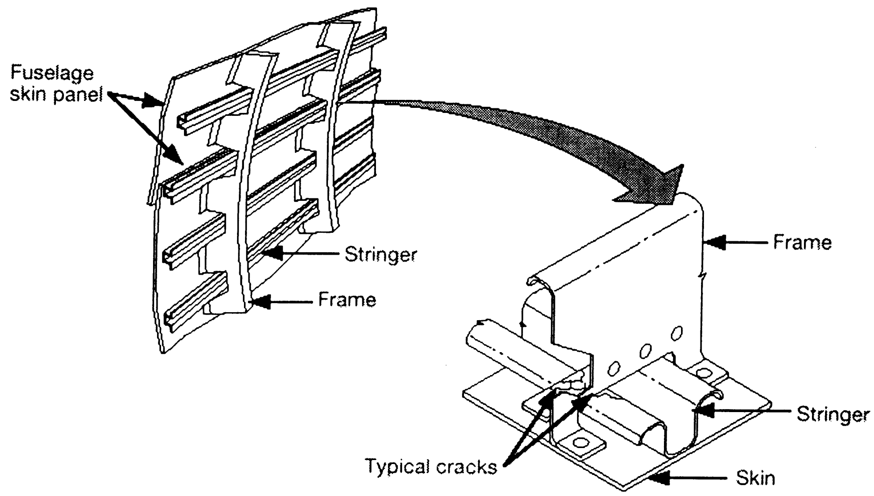




Type and possible location of MSD/MED
- MSD—circumferential joint
  - Without outer doubler
    - Splice plate—between and/or at the inner two rivet rows
    - Skin—forward and aft rivet row of splice plate
    - Skin—at first fastener of stringer coupling
  - With outer doubler
    - Skin—outer rivet rows
    - Splice plate/outer doubler—inner rivet rows
  - MED—stringer/stringer couplings
    - Stringer—at first fastener of stringer coupling
    - Stringer coupling—in splice plate area

Service or test experience of factors that influence MSD and/or MED (examples)
- High secondary bending
- High stress level in splice plate and joining stringers (misuse of data from coupon test)
- Poor design (wrong material)
- Underdesign (over-estimation of interference fit fasteners)

Figure A2-2 ***Circumferential Joints and Stringers (MSD/MED)***



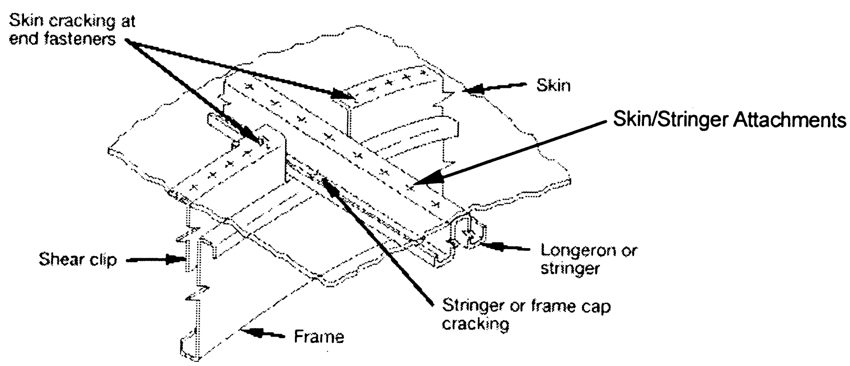
Type and possible location of MED

- MED—any combination of fracture of frames, clips, or stringers, including the attachments, resulting in the loss of the shear tie between the frame and stringer. This condition may occur at either circumferential or longitudinal locations at fuselage frame/stringer intersection.

Service or test experience of factors that influence MSD and/or MED (examples)

- Poor load path connection

Figure A2-5 ***Stringer to Frame Attachments (MED)***



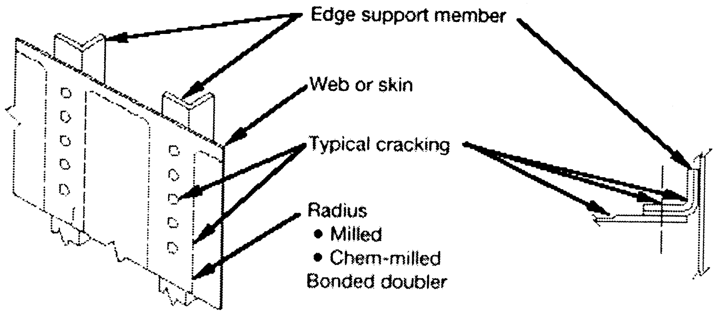
Type and possible location of MSD and MED

- MSD—skin at end fastener of shear clip
- MED—cracking in stringer or longeron at frame attachment
- MED—cracking in frame at stringer or longeron attachment

Service or test experience of factors that influence MSD and MED (examples)

- Preload
- Localized bending due to pressure
- Discontinuous load path

Figure A2-6 ***Shear Clip End Fasteners on Shear Tied Fuselage Frame (MSD/MED)***



Type and possible location of MSD and MED

Abrupt change in stiffness*
- Milled radius
- Chem-milled radius
- Bonded doubler
- Fastener row at edge support members

Edge member support structure
- Edge member - in radius areas

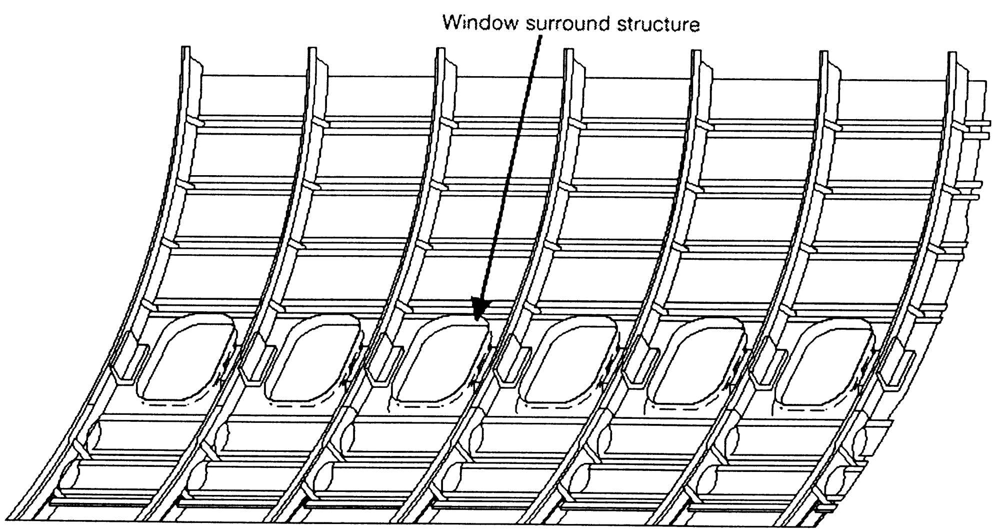
Service or test experience of factors that influence MSD and MED

Pressure structure
- High bending stresses at edge support due to pressure

Non-pressure structure
- Structural deflections cause high stresses at edge supports

* Often multiple origins along edge member

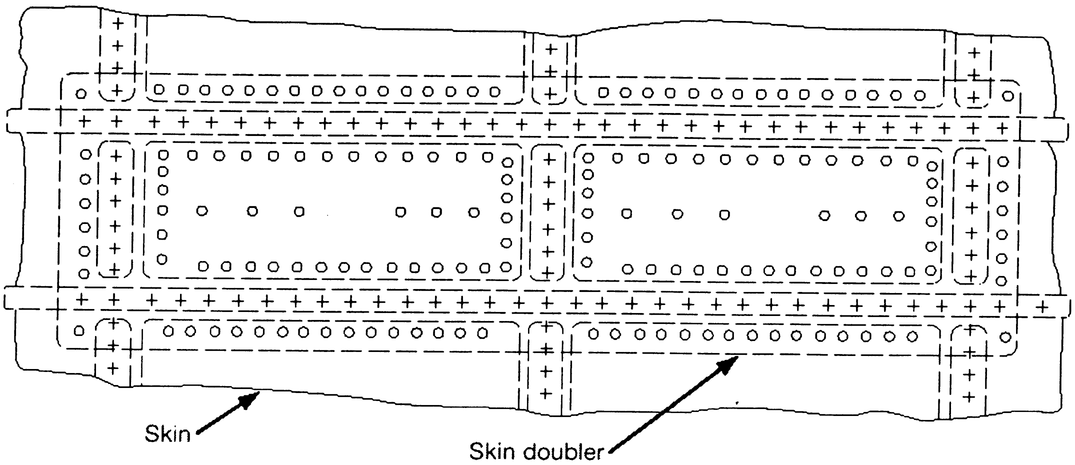
Figure A2-9 *Abrupt Changes in Web or Skin Thickness — Pressurized or Unpressurized Structure (MSD/MED)*



Type and possible location of MSD/MED
- MSD—skin at attachment to window surround structure
- MED—repeated details in reinforcement of window cutouts or in window corners

Service or test experience of factors that influence MSD and/or MED (examples)
- High load transfer

Figure A2-10 *Window Surround Structure (MSD, MED)*



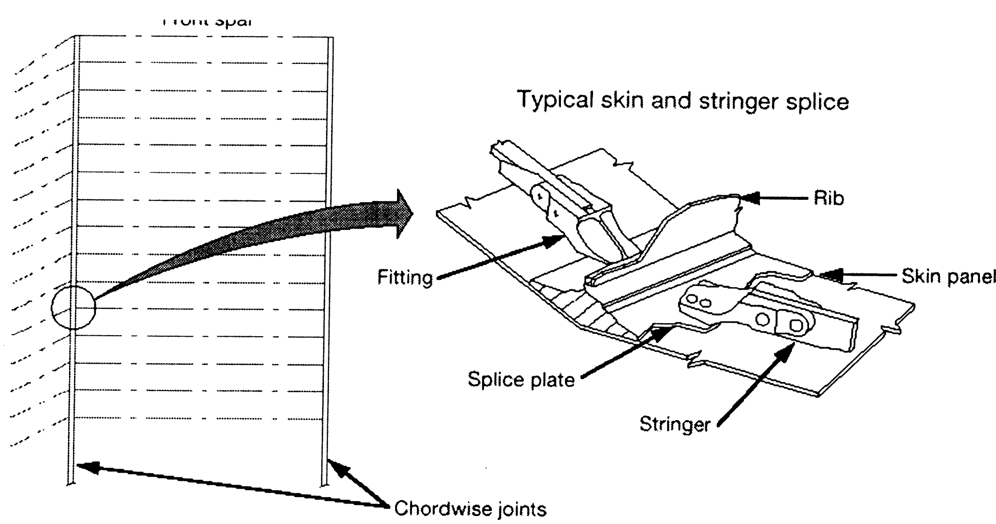
Type and possible location of MSD/MED

- MSD—cracks initiated at multiple critical fastener holes in skin at runout of doubler

Service or test experience of factors that influence MSD and/or MED (examples)

- High load transfer—high local stress

Figure A2-13 ***Skin at Runout of Large Doubler (MSD) — Fuselage, Wing or Empennage***



Type and possible location of MSD/MED

- MSD—skin and/or splice plate
  - Chordwise critical fastener rows
- MED—stringer runout of fitting
  - Fatigue-critical fastener holes at stringer and/or fitting

Service or test experience of factors that influence MSD and/or MED (examples)

- High load transfer
- Local bending

Figure A2-14 ***Wing or Empennage Chordwise Splices (MSD/MED)***

c. **WFD Evaluation.** By the time the highest-time airplane of a particular model reaches its DSG, the evaluation for each area susceptible to the development of WFD should be completed. A typical evaluation process is shown in Figure A2-17. This evaluation will establish the necessary elements to determine a maintenance program to preclude WFD in that particular model's commercial airplane fleet. These elements are developed for each susceptible area and include:

d. Determination of WFD average behavior in the fleet:

(1) The time in terms of flight cycles/hours to the WFD average behavior in the fleet should be established. The evaluation should include:

- a complete review of the service history of the susceptible areas (including operational statistics of the fleet in terms of flight hours and landings),
- significant production variants (material, design, assembly method, and any other change that might affect the fatigue performance of the detail),
- relevant full-scale and component fatigue test data,
- teardown inspections, and
- any fractographic analysis available.

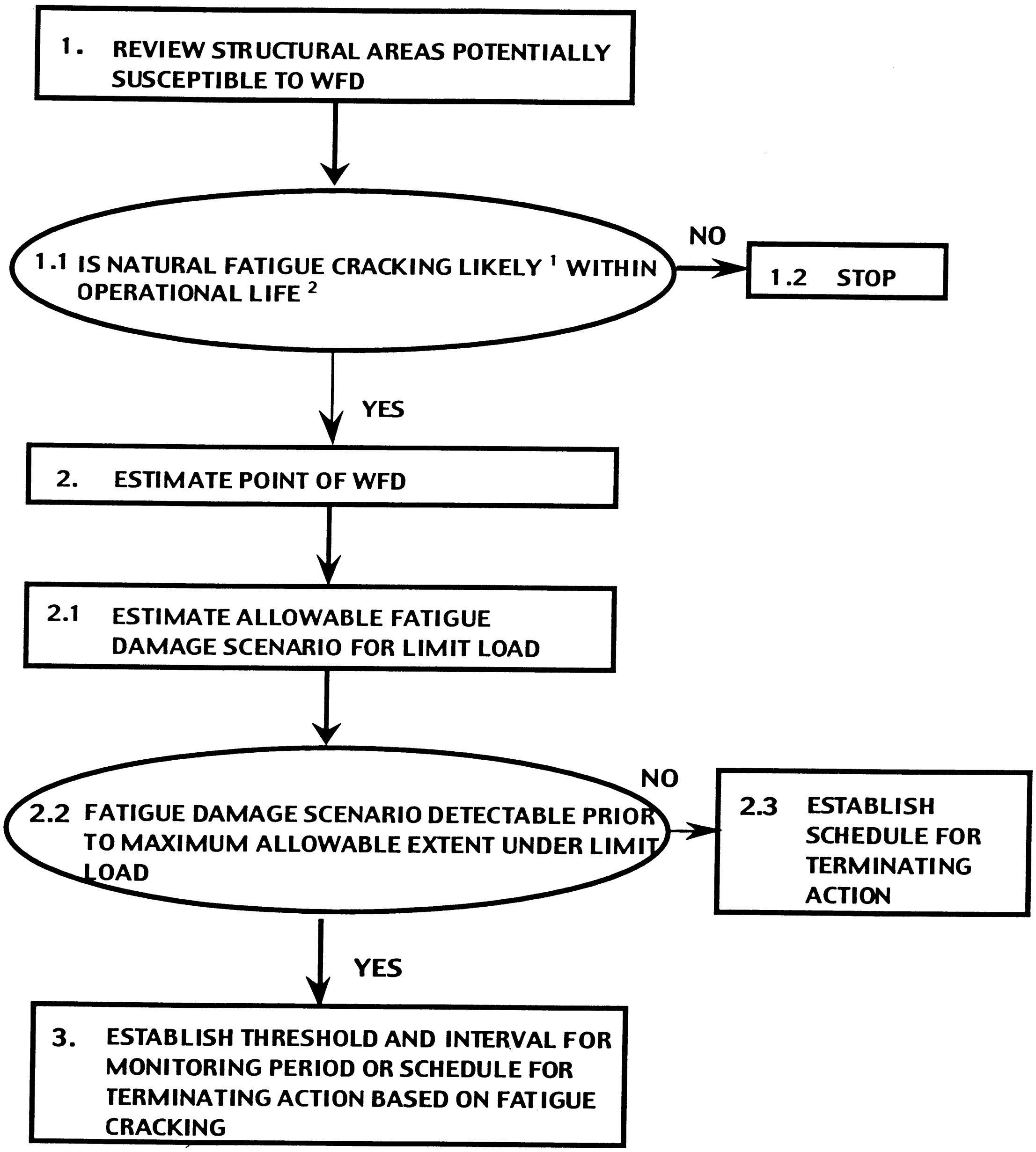
The evaluation of the test results for the reliable prediction of the time to when WFD might occur in each susceptible area should include appropriate test-to-structure factors. If fatigue test evidence is used, Figure A2-18, relates how that data might be reduced in determining WFD Average Behavior. Evaluation may be analytically determined, supported by test or service evidence.

(2) Initial Crack/Damage Scenario: This is an estimate of the size and extent of multiple cracking expected at MSD/MED initiation. This prediction requires empirical data or an assumption of the crack/damage locations and sequence plus a fatigue evaluation to determine the time to MSD/MED initiation. Alternatively, analysis can be based on either:

- the distribution of equivalent initial flaws, as determined from the analytical assessment of flaws found during fatigue test and/or teardown inspections regressed to zero cycles; or
- a distribution of fatigue damage determined from relevant fatigue testing and/or service experience.

(3) Final Cracking Scenario: This is an estimate of the size and extent of multiple cracking that could cause residual strength to fall to certification levels. Techniques exist for 3-D elastic-plastic analysis of such problems; however, there are several alternative test and analysis approaches available that provide an equivalent level of safety. One such approach is to define the final cracking scenario as a sub-critical condition (e.g., first crack at link-up at limit load). Use of a

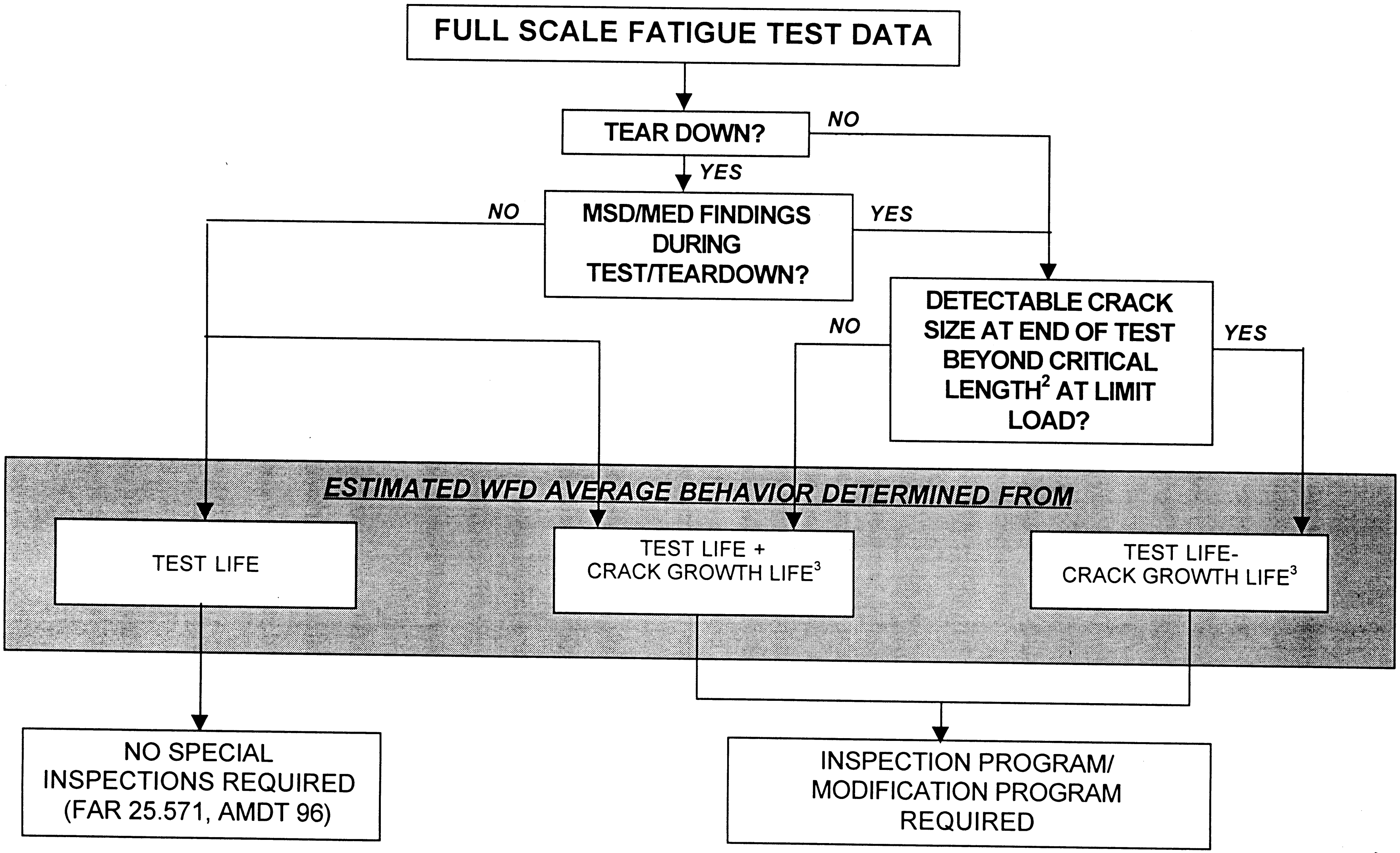
AIRPLANE EVALUATION PROCESS – STEP 1



NOTES

1. Fatigue cracking is defined as likely if the factored fatigue life is less than the projected ESG of the airplane at time of WFD evaluation.
2. The operational life is the projected ESG of the airplane at time of WFD evaluation.

Figure A2-17 *Airplane Evaluation Process, Part 1 of 2*



1 **ASSUMED STATE AT END OF TEST**: Best estimate of non-detected damage from inspection method used at end of test or during teardown.
2 **CRITICAL CRACK LENGTH**: First link-up of adjacent cracks at limit load (locally) or an adequate level of large damage capability.
3 **CRACK GROWTH LIFE**: Difference between assumed state at end of test and critical crack length.

Figure A2-18 *Use of Fatigue Test and Teardown Information to Determine WFD Average Behavior*

(7) Inspection Start Point (ISP): This is the point at which inspection starts if a monitoring period is used. It is determined through a statistical analysis of crack initiation based on fatigue testing, teardown, or service experience of similar structural details. It is assumed that the ISP is equivalent to a lower bound value with a specific probability in the statistical distribution of cracking events. Alternatively, the ISP may be established by applying appropriate factors to the average behavior.

(8) MED Considerations: Due to the redundant nature of semi-monocoque structure, MED can be difficult to manage in a fleet environment. This stems from the fact that most airplane structures are built-up in nature, and that makes the visual inspection of the various layers difficult. Also, visual inspections for MED rely on internal inspections and, therefore, recurring intervals are normally much greater than for external skin inspections. However, these issues are dependent on the specific design involved and the amount of damage being considered. In order to implement a viable inspection program for MED, the following conditions must be met:

(a) Static stability must be maintained at all times.

(b) Large damage capability should be maintained.

(c) There is no concurrent MED with MSD in a given structural area.

(9) Structural Modification Point (SMP).

(a) The applicant should demonstrate that the proposed SMP established during the audit has the same confidence level as current regulations require for new certification. In lieu of other acceptable methods, the SMP can be established as a point reduced from the WFD Average Behavior, based on the viability of inspections in the monitoring period. The SMP can be determined by dividing the WFD Average Behavior by a factor of 2 if there are viable inspections, or by a factor of 3 if inspections are not viable.

(b) Whichever approach is used to establish the SMP, a study should be made to demonstrate that the approach ensures that the expected extent of MSD/MED at the SMP still has a LDC to address damage from sources such as accidental damage, fatigue damage, or environmental degradation.

(c) An airplane may not be operated past the SMP unless the structure is modified or replaced, or unless additional approved data is provided that would extend the SMP. However, if during the structural evaluation for WFD, a TCH finds that the flight cycles and/or flight hours SMP for a particular structural detail have been exceeded by one or more airplanes in the fleet, the TCH should expeditiously evaluate selected high time airplanes in the fleet to determine their structural condition. From this evaluation, the TCH should notify the airworthiness authorities and propose appropriate service actions independent of the audit.

(1) For all areas that have been identified as susceptible to MSD/MED, the current maintenance program should be evaluated to determine if adequate structural maintenance and inspection programs exist to safeguard the structure against unanticipated cracking or other structural degradation. The evaluation of the current maintenance program typically begins with the determination of the SMP for each area.

(2) Each area should then be reviewed to determine the current maintenance actions that are directed against the structure and compare them to the maintenance requirements.

(a) Determine the inspection requirements (method, inspection start point, and repeat interval) of the inspection for each susceptible area (including that structure that is expected to arrest cracks) that is necessary to maintain the required level of safety.

(b) Review the elements of the existing maintenance programs already in place

(c) Revise and highlight elements of the maintenance program necessary to maintain safety.

(3) For susceptible areas approaching the SMP, where the SMP will not be increased, or for areas that cannot be reliably inspected, a program should be developed and documented that provides for replacement or modification of the susceptible structural area.

e. **Period of Evaluation Validity**:

(1) The initial evaluation of the complete airframe should cover a significant forward estimation of the projected airplane usage beyond its DSG, also known as the "proposed ESG." Typically, an assessment through at least an additional twenty-five percent of the DSG would provide a realistic forecast, with reasonable planning time for necessary maintenance action. However, it may be appropriate to vary the evaluation validity period depending on issues such as:

(a) the projected useful life of the airplane at the time of the initial evaluation;

(b) current non-destructive inspection (NDI) technology; and

(c) airline advance planning requirements for introduction of new maintenance and modification programs, to provide sufficient forward projection to identify all likely maintenance/modification actions essentially as one package.

(2) Upon completion of the evaluation and publication of the revised maintenance requirements, the "proposed ESG" becomes the ESG. Subsequent evaluations should follow similar validity period guidelines as the initial evaluation.

(4) Any mandatory modification or replacement of the structural element;

(5) service bulletins (or other service information publications) revised or issued as a result of in-service findings resulting from the WFD evaluations (added as a revision to the initial WFD document); and

(6) guidance to the operator on which inspection findings should be reported to the manufacturer, and appropriate reporting forms and methods of submittal.

5. REPORTING REQUIREMENTS

a. Operators, STC Holders and TCHs are required to report in accordance with various regulations, for example § 121.703, § 21.3, etc. (The regulations to which this AC relates do not require any reporting requirements in addition to the current ones.) Due to the potential threat to structural integrity, the results of inspections must be accurately documented and reported in a timely manner to preclude the occurrence of WFD. The current system of operator and manufacturer communication has been useful in identifying and resolving a number of issues that can be classified as WFD concerns. MSDMED has been discovered via fatigue testing and in-service experience. Airplane TCH's have been consistent in disseminating related data to operators to solicit additional service experience. However, a more thorough means of surveillance and reporting is essential to preclude WFD.

b. When damage is found while conducting an FAA-approved MSD/MED inspection program, or at the SMP where replacement or modification of the structure is occurring, the TCHs, STC Holders and the operators need to ensure that greater emphasis is placed on accurately reporting the following items:

- a description (with a sketch) of the damage, including crack length, orientation, location, flight cycles/hours, and condition of structure;
- results of follow-up inspections by operators that identify similar problems on other airplanes in the fleet;
- findings where inspections accomplished during the repair or replacement/modification identify additional similar damage sites; and
- adjacent repairs within the same PSE.

c. Operators should report all cases of MSD/MED to the TCH, STC Holder or the FAA as appropriate, irrespective of how frequently such cases occur. Cracked areas from in-service airplanes (damaged structure) may be needed for detailed examination. Operators are encouraged to provide fractographic specimens whenever possible. Airplanes undergoing heavy maintenance checks are perhaps the most useful sources for such specimens.

- a modification that results in operational mission change that significantly changes manufactures load/stress spectrum (for example, a passenger-to-freighter conversion); and
- a modification that changes areas of the fuselage from being externally inspectable using visual means to being uninspectable (for example, a large external fuselage doubler that resulted in hidden details, rendering them visually uninspectable).

7. RESPONSIBILITY. It is expected that the evaluation will be conducted in a cooperative effort between the operators and TCH's, with participation by the appropriate airworthiness authorities during the evaluation.